Summer 2010 Climate Summary For Southwest Lower Michigan

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Overview

The 2010 summer season over Southwest Lower Michigan featured well above normal temperatures while precipitation was near to above normal (Table 1). The frequency of days with maximum temperatures of least 80 degrees, minimum temperatures of at least 65 degrees, and minimum temperatures of at least 70 degrees were significantly greater than normal. The frequency of severe thunderstorms also was significantly greater than normal.

TABLE 1. Reported temperature and precipitation for the summer of 2010 at the primary climate stations in Southwest Lower Michigan. Normals are computed from 30 year averages from 1971-2000.

Location		Average Temperature (degrees F)	Precipitation (inches)	Snowfall (inches)
Grand Rapids	*Reported*	73.2	14.44	0.0
	Normal	69.3	11.01	0.0
	Departure	+ 3.9	+ 3.43	0.0
	Record Max Avg (year)	74.6 (1921)		
	Record Min Avg (year)	65.5 (1992)		
	Record Max (year)	108 (1936)	22.63 (1994)	0.0
	Record Min (year)	32 (1945)	3.18 (1918)	0.0
Lansing	*Reported*	72.4	7.01	0.0
	Normal	68.3	9.74	0.0
	Departure	+ 4.1	- 2.73	0.0
	Record Max Avg (year)	73.7 (1955)		
	Record Min Avg (year)	65.1 (1915)		
	Record Max (year)	102 (1934)	22.78 (1883)	0.0
	Record Min (year)	26 (1863)	2.16 (1884)	0.0
Muskegon	*Reported*	72.6	9.84	0.0
	Normal	67.8	8.67	0.0
	Departure	+ 4.8	+ 1.17	0.0
	Record Max Avg (year)	72.6 (2010)		
	Record Min Avg (year)	63.3 (1929)		
	Record Max (year)	99 (1913)	19.15 (1905)	0.0
	Record Min (year)	36 (1979)	3.00 (1930)	0.0

TABLE 2. The top 10 warmest summers for all of Southwest Lower Michigan using the 36 long term climate stations.

Rank	Year	Summer Temp.	Departure from Normal
1	**1921**	72.7	4.3
2	**1955**	72.4	4.1
3	**1901**	71.9	3.6
4	**1995**	71.9	3.6
5	**1988**	71.7	3.3
6	**1949**	71.5	3.2
7	**2005**	71.5	3.1
8	**2010**	71.4	3.0
9	**1919**	71.2	2.9
10	**1983**	71.1	2.8

Table 3. Summer 2010 temperature frequencies at the primary climate stations.

Number of days	Grand Rapids	Lansing	Muskegon
highs ≥ 90 (2010)	8	9	4
highs ≥ 90 (2009)	3	3	1
highs ≥ 90 (normal)	10.0	8.0	2.1
highs ≥ 90 (record)	36	35	20
year(s) of record	1988	1988	1955
highs ≥ 80 (2010)	68	67	60
highs ≥ 80 (2009)	40	33	23
highs ≥ 80 (normal)	52.2	53.7	42.8
highs ≥ 80 (record)	73	74	65
year(s) of record	1898,1899	1894,1895	1955
lows ≥ 70 (2010)	20	12	22
lows ≥ 70 (2009)	5	4	4
lows ≥ 70 (normal)	5.7	4.4	4.1
lows ≥ 70 (record)	20	15	22
year(s) of record	1921,2010	1954	1931, 2010
lows ≥ 65 (2010)	44	37	50
lows ≥ 65 (2009)	15	13	14
lows ≥ 65 (normal)	20.7	18.1	18.3
lows ≥ 65 (record)	51 (1921)	45 (1955)	50 (2010)
lows < 60 (2010)	17	24	20
lows < 60 (2009)	55	61	55
lows < 60 (normal)	49.4	56	51.3
Least lows < 60 (record)	17(2010)	24(2010)	20 (2010)

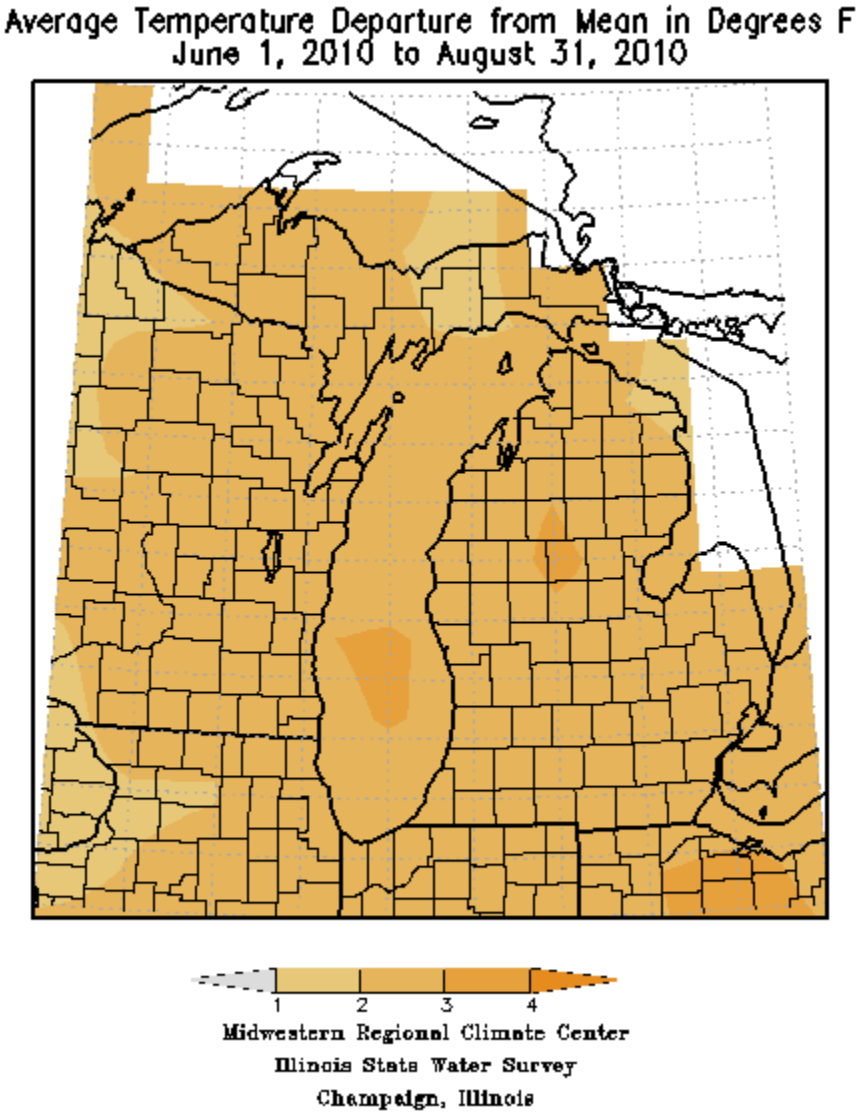


Figure 1. The summer 2010 daily mean temperature departure from normal for Michigan.

The areal averaged summer mean temperature was 71.4°F, which was 3.0°F warmer than the 1971 to 2000 normal (Figure 1). This was the eighth warmest summer on record for Southwest Lower Michigan since records began in 1895. The warmest summer on record was the summer of 1921, which averaged 72.7 degrees. Half of the top ten warmest summers have occurred in the past 30 years (Table 2). By comparison, the 65.9°F mean for the summer of 2009 was the fourth coldest on record. The NCDC state ranking map, shown in Figure 2, reveals the state of Michigan also had the eighth warmest summer on record, like Southwest Lower Michigan.

One of the more unusual features of this summer was the high frequency for days with highs of 80°F, and frequency of days with lows warmer then 65°F and 70 °F (Table 3). At Grand Rapids (20) and Muskegon (22), the frequency of lows of 70 degrees or warmer tied the all time record.

The lack of cool weather was also record breaking. At all three primary climate stations, Grand Rapids (17), Lansing (24), and Muskegon (20) broke their respective all time records for the least number of days the low temperature was below 60 degrees.

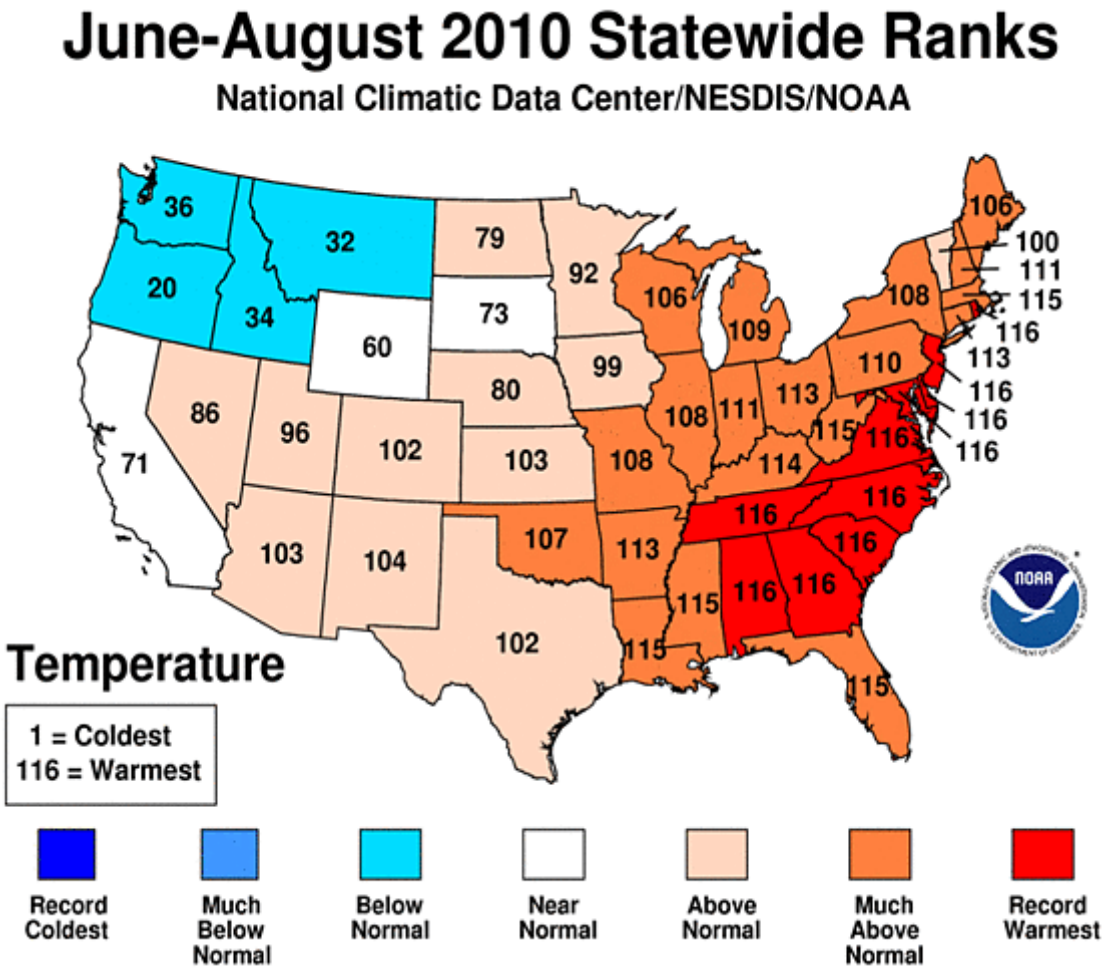


Figure 2. The summer 2010 temperature ranking for the contiguous United States.

Looking at all the summers from 1999 through 2008 for Southwest Lower Michigan, there is a recent trend toward warmer summers when considering all thirty-six climate stations (Figure 3). Four of the past ten summers were warmer than normal while three were colder than normal, leaving three summers near normal (Figure 4). The summer of 2009 was one of the coldest summers on record in this area.

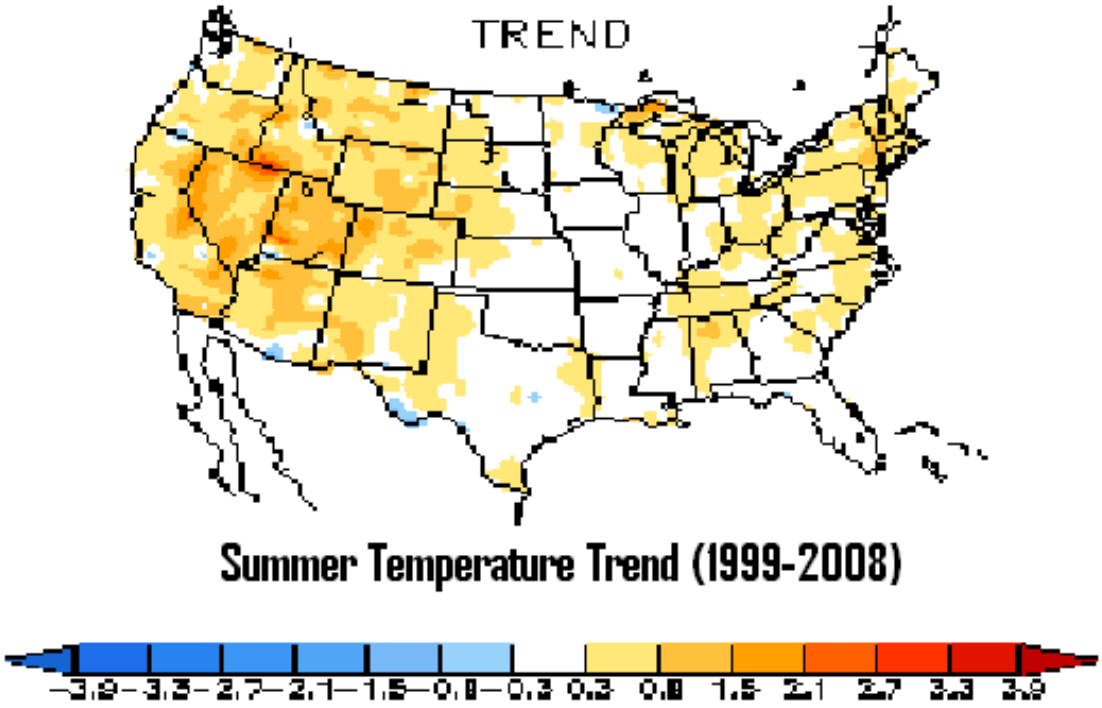


Figure 3. Summer (June-August) temperature trend. The trend is the mean temperature over the past ten years (1999-2008) minus the 1971-2000 mean.

Summers have mostly been warmer than normal since the summer of 1983 (Figure4). Since then, 46% of the summers were warmer than normal (>0.9 degrees above normal) and 32% of those summers were colder than normal (<0.8 below normal). Between 1958 and 1982, 58% of the summers were near normal, only 13% of the summers were warm, and 29% of the summers were cold.

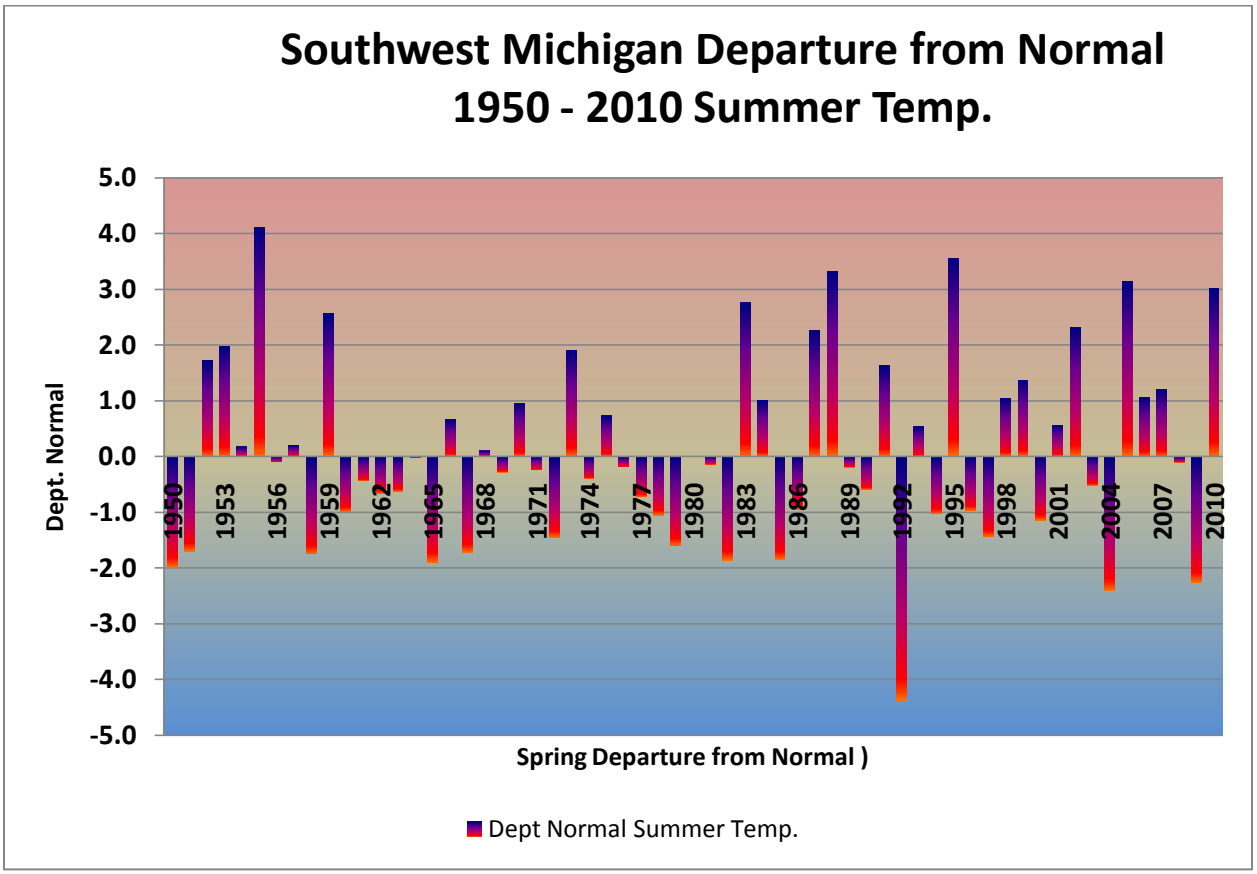


Figure 4. Summer mean temperature departure from normal for all of Southwest Lower Michigan from 1950 through 2010 using the 36 long-term climate stations.

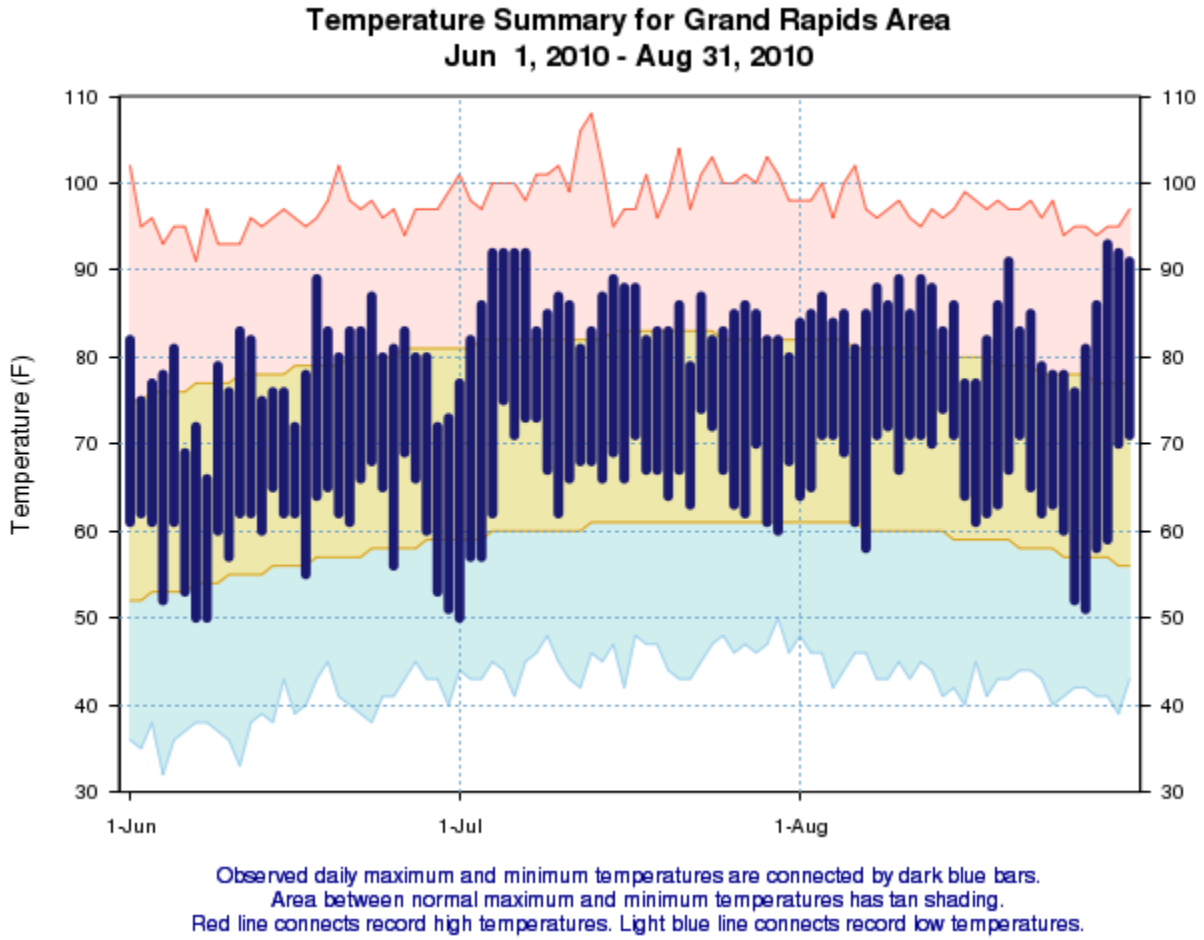


Figure 5. Summer 2010 daily temperatures for Grand Rapids. Daily maximum and minimum temperatures area connected are connected by dark blue bars. The area between the maximum and minimum normal temperatures has tan shading. Red lines connect the record high temperatures. Blue lines connect the record low temperatures.

Figures 5-7 show the daily temperature was mostly above normal for this past summer. There were two heat waves, July 4th through July 7th and 29th through the 31st of August. These heat waves occurred in both Lansing and Grand Rapids. However, Muskegon, being closer to Lake Michigan, did not get warm enough for a heat wave. Periods of cooler than normal temperatures were nearly absent during the summer of 2010. Note that while the normal daily low for Grand Rapids, Lansing and Muskegon is near 60 degrees by midsummer, lows were more in the mid 60 to lower 70s than in the 50s, which would be the typical summer low temperatures in Southwest Lower Michigan.

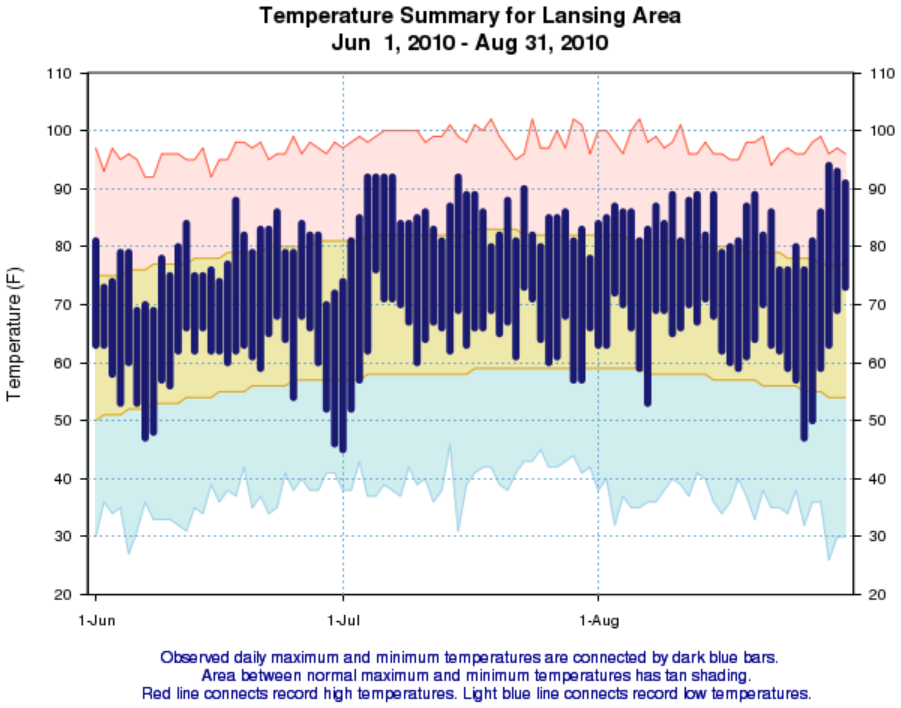


Figure 6. Same as Figure 5, expect for Lansing.

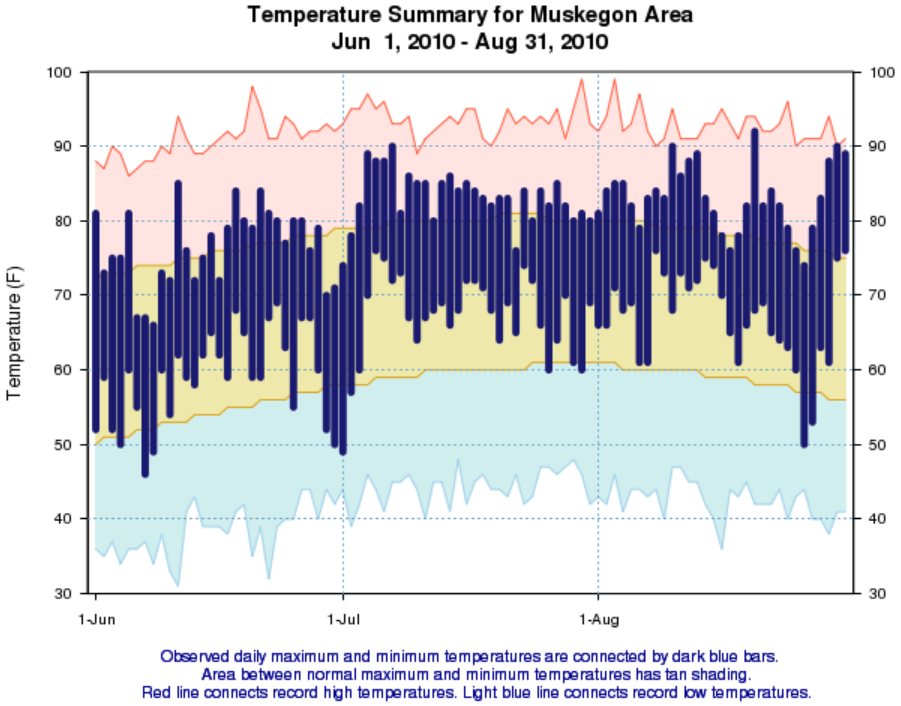
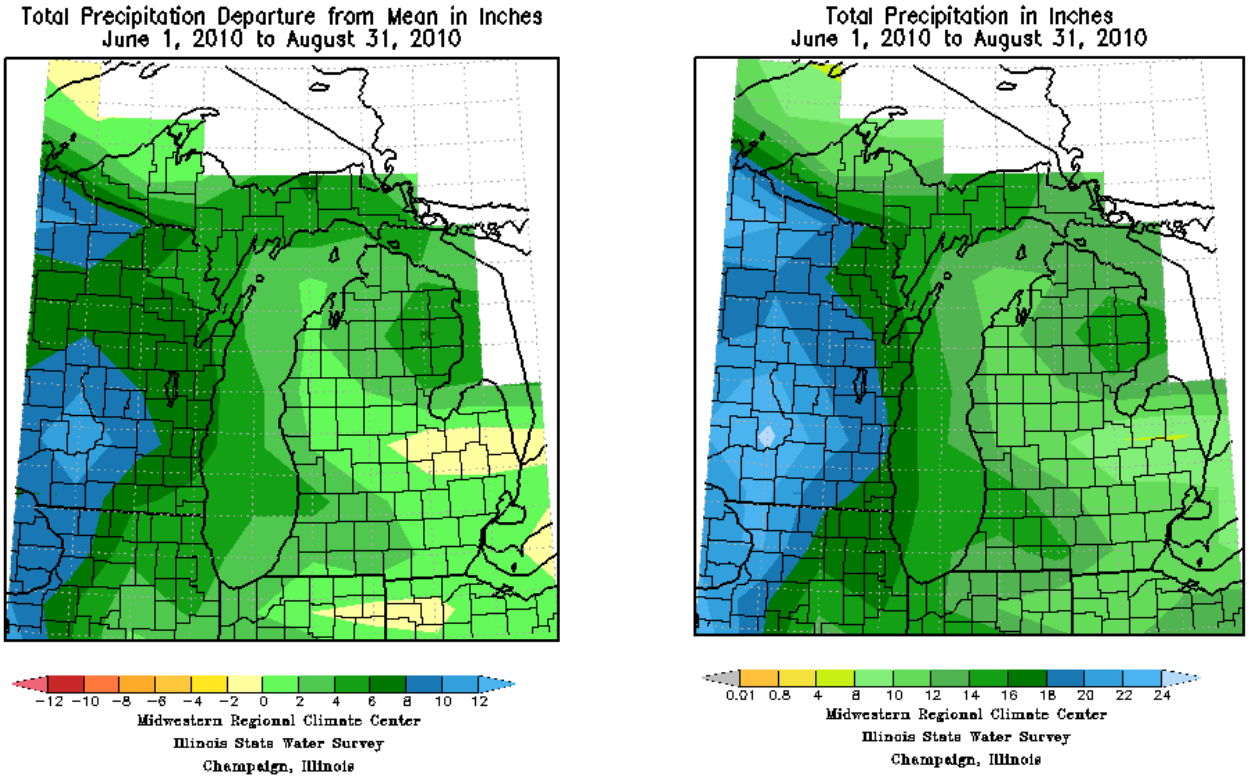


Figure 7. Same as Figure 6, expect for Muskegon.



8A 8B

Figure 8. Summer total precipitation (A) and departure from normal (B) for Michigan.

The total precipitation ranged from 5.78 inches in Portland to 19.08 inches at Gull Lake. Figure 8A displays the fairly widespread coverage of 12 to 16 inch totals. The mean precipitation for Southwest Lower Michigan was 11.49 inches, which was 1.23 inches above normal. Most areas of Southwest Lower Michigan were between two and six inches above normal (Figure 8B). For the state of Michigan, this was the 3rd wettest summer out of 116 years (Figure 9). For Southwest Lower Michigan, the ranking was 12th wettest out of 116 years. During the past fifteen years (1996 to 2010), there has been a trend toward drier summers over Southwest Lower Michigan (Figure 10). The mean for the 15 years ending in 1996 was 10.28 inches; by 2010 the 15 year mean was down to 9.91 inches. During this time, four years were wetter than normal (1999, 2000, 2004 and 2010), four years below normal (1998, 2002, 2003, and 2005) and seven years were near normal (1996, 1997, 2001, 2006, 2007, 2008 and 2009, Figure 11). The average of the below normal departures from normal (-1.62") was nearly three times larger on average than the above normal departures (+0.58") from normal, which helps explain the trend toward drier summers, even through the frequencies of above and below normal precipitation summers were the same.

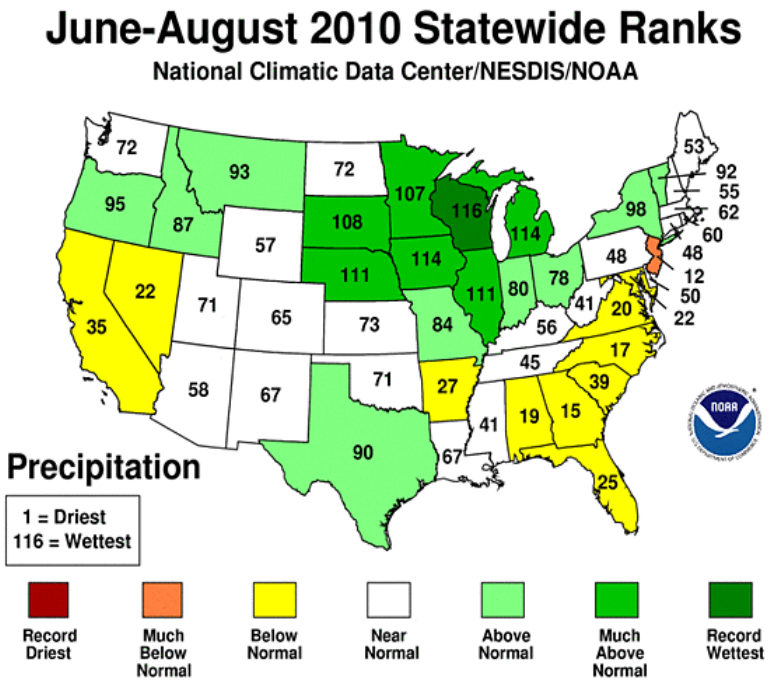


Figure 9. The NCDC summer precipitation ranking for the contiguous United States.

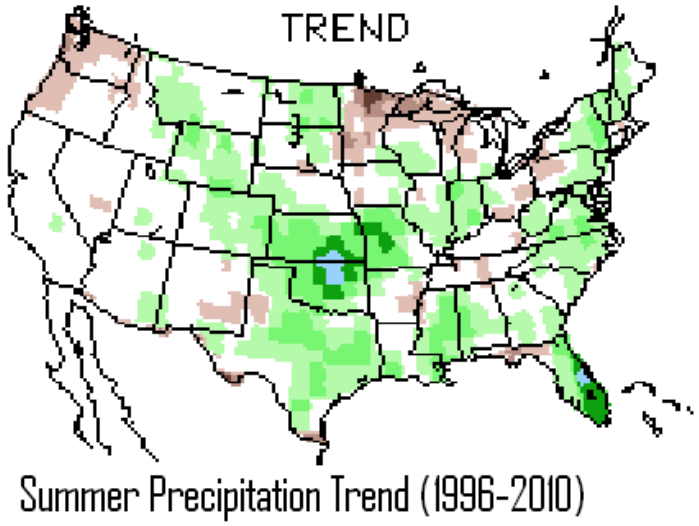


Figure 10 Summer precipitation trend.

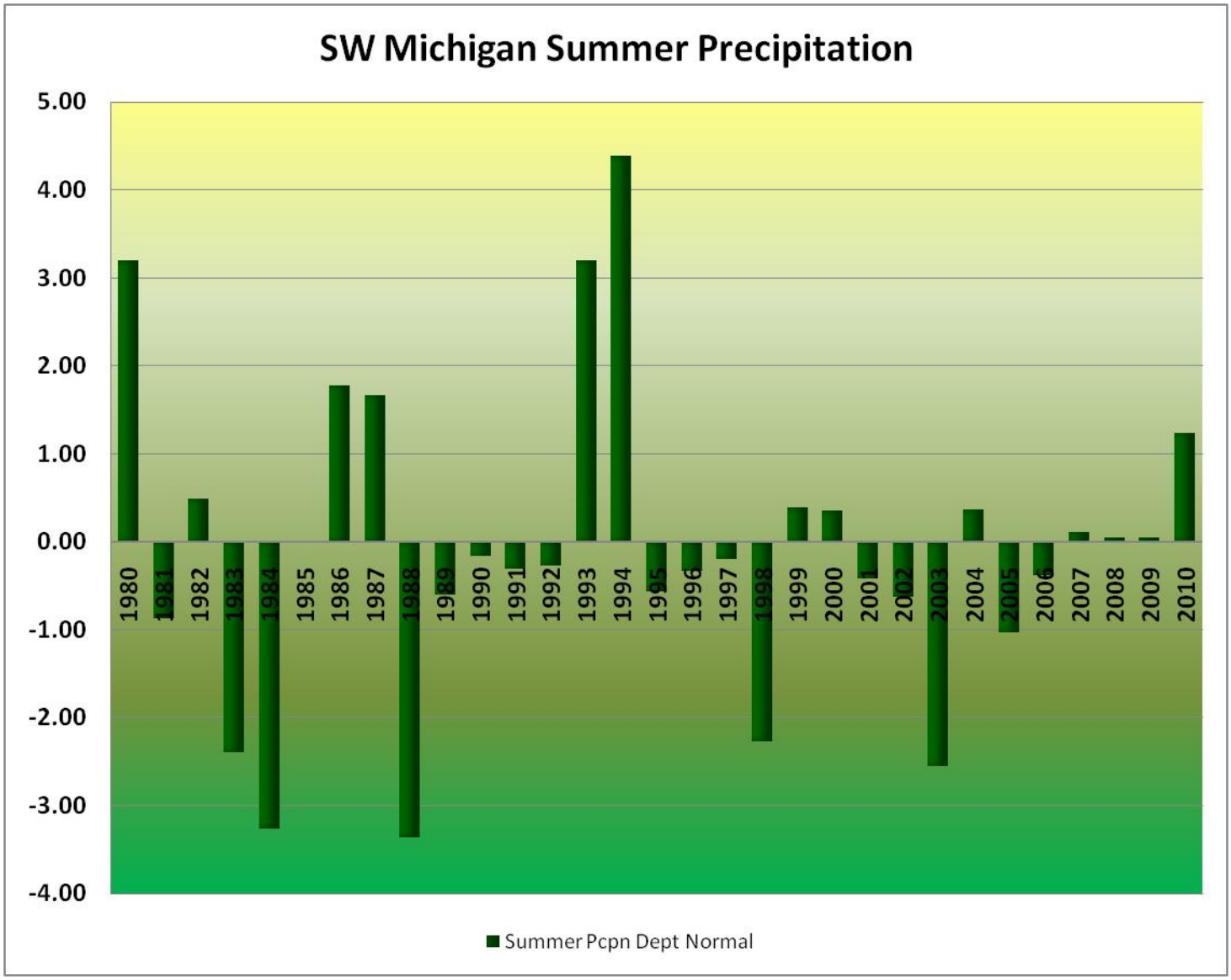


Figure 11. Total summer precipitation departure from normal for all of Southwest Lower Michigan from 1980 through 2009 using the 36 long-term climate stations.

As for the daily precipitation distribution at the primary climate sites, Grand Rapids and Muskegon received the heaviest precipitation in June, but both July and August remained wet enough to keep the total precipitation for the summer above normal (Figures 12 and 14). The Lansing area was one of the drier areas, as precipitation totals fell below normal in early July and stayed below normal through much of the remainder of the summer (Figure 13).

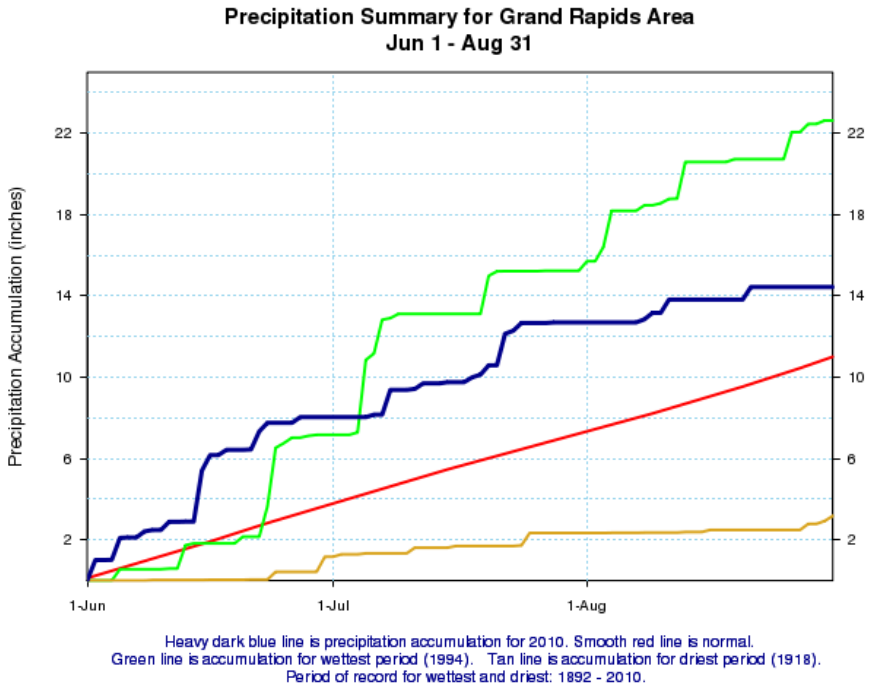


Figure 12. Grand Rapids daily precipitation accumulation for the summer of 2010.

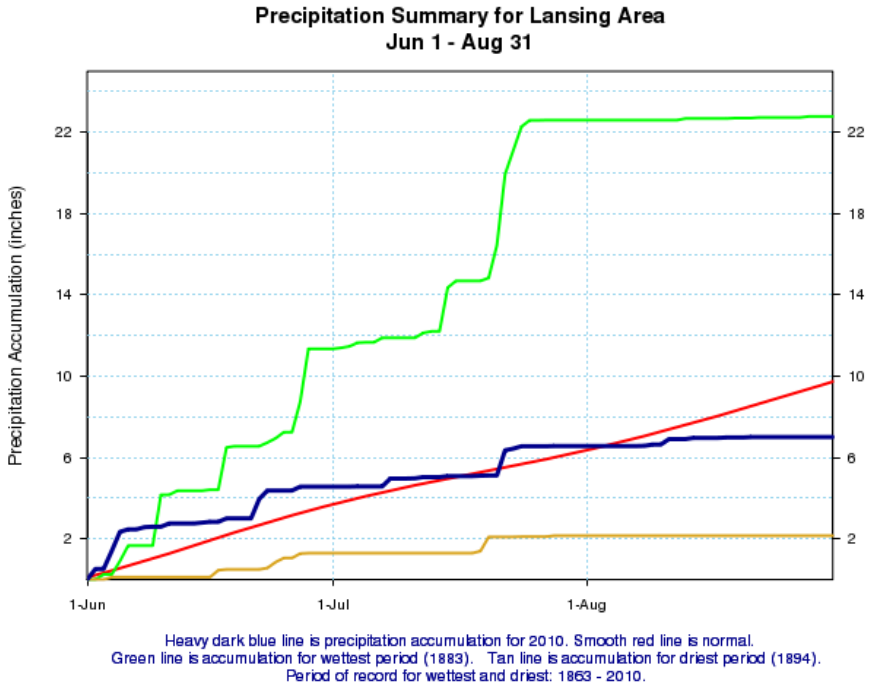


Figure 13. Lansing daily precipitation accumulation for the summer of 2010.

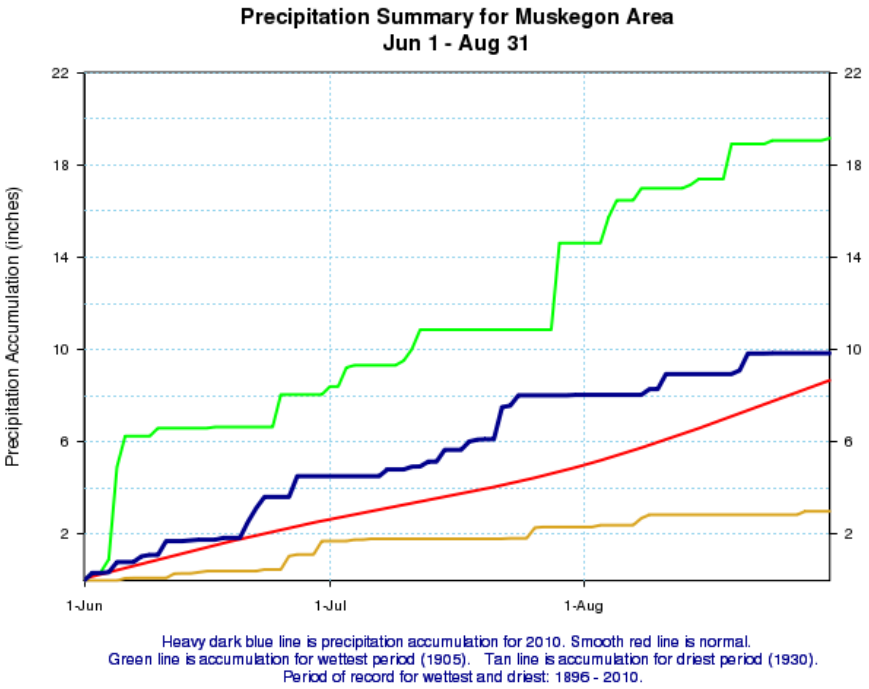


Figure 14. Muskegon daily precipitation accumulation for the summer of 2010.

The summer of 2010 had nine severe weather episodes (Figure 15). Since 2001, the average number of severe storm events is ten. This was more than twice the number of events (four) that occurred in 2009. Most of the severe storms occurred in June (5 episodes), and July (4 episodes). Five tornadoes were reported during the summer of 2010 in Southwest Lower Michigan. There were three tornado events in June: an EF-1 near Battle Creek on the 6th, an EF-0 near Zeeland on the 23rd, and on the 27th there was an EF-0 tornado near Gobles in Van Buren County. In July there were two more tornadoes, an EF-0 on the 18th in Allegan County, and another EF-0 in Allegan County on the 22nd.

The total number of severe storm episodes was near normal; however, the total number of severe storm events was nearly 20 percent above normal. There were 109 severe storm events reported during the summer of 2010, mostly in June and July (Figure 16). That was 17 events above the normal of 92 events for the 2000 to 2010 period. The greatest number of events was 174 in 2008. Last year there were only 35 events, which was the lowest for any summer since the 15 events during the summer of 1990.

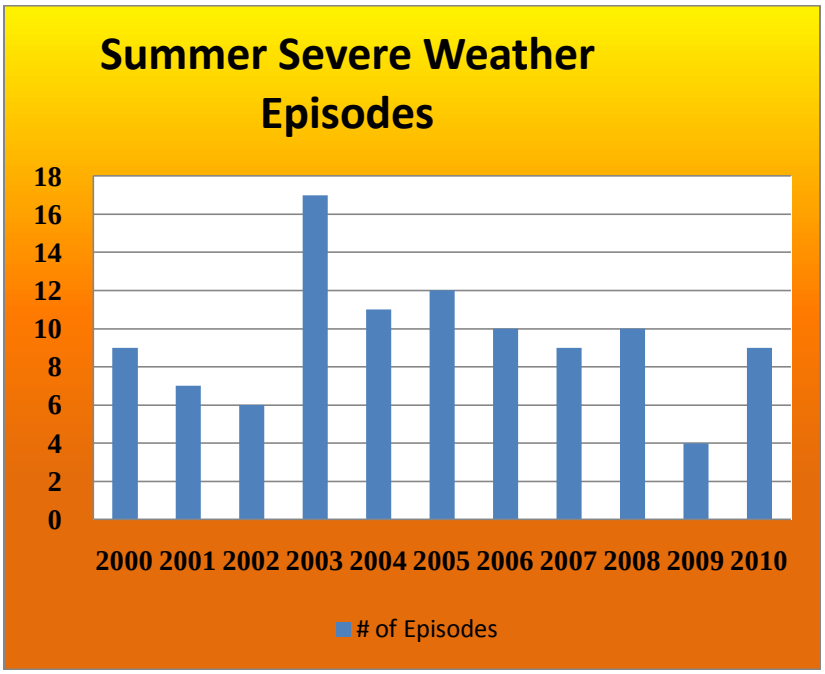


Figure 15. Summer severe weather episode total from 2000 through 2010.

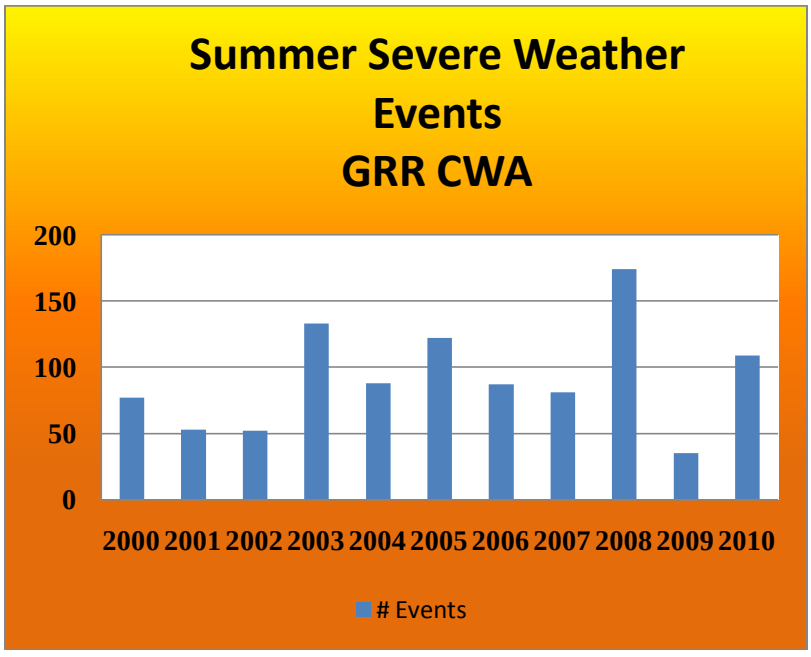


Figure 16. Summer severe weather events total from 2000 through 2010.

For more details on the individual precipitation events, see the monthly weather summaries listed below:

June 2010 Climate Summary http://www.crh.noaa.gov/images/grr/climate/CS200906.pdf

July 2010 Climate Summary.....http://www.crh.noaa.gov/images/grr/climate/CS200907.pdf

August 2010 Climate Summary.....http://www.crh.noaa.gov/images/grr/climate/CS200908.pdf